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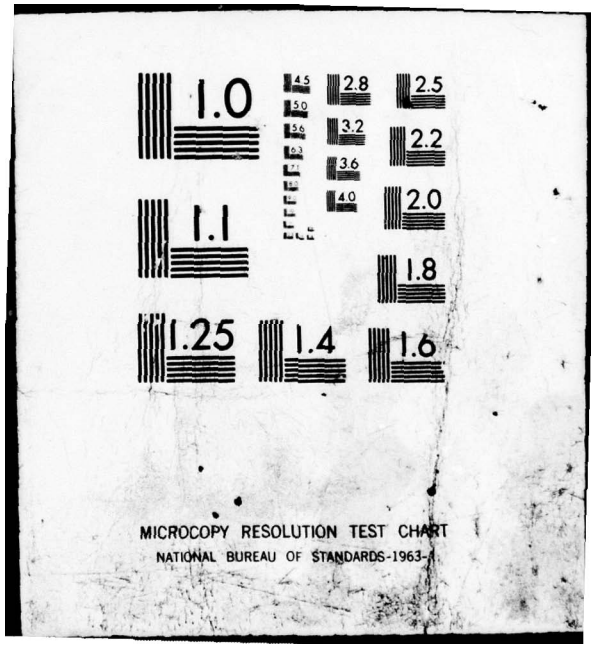
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Behavioral Measurement in Business, Industry, and Government

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This report presents some of the advantages of using behavioral measures in business, industry, and government settings. The development of a behavioral measurement system is illustrated by an example from the authors' recent experience in conducting a study designed to improve organizational maintenance in a Fleet Marine Force Unit. Areas of concern related to behavioral measures, knowledge of being observed, observer bias, and the costs of using observational measures are discussed. (69 references)

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Behavioral Measurement in Business, Industry, and Government

With the large scale implementation of a positive reinforcement program at Emery Air Freight in the late sixties ("Performance Audit," 1972), the possibilities for the application of behavioral principles in work settings recognized by Skinner (1953; "Conversation with B. F. Skinner," 1973) and others (Brethower, 1972; Campbell, 1971; Nord, 1969; Porter, 1973) began to be realized. Recent studies in such outlets as the Journal of Applied Psychology, Organizational Behavior and Human Performance, and the Journal of Applied Behavior Analysis demonstrate the effectiveness of the approach. The appearance of new outlets such as the Journal of Organizational Behavior Management and the continued appearance of books (Connellan, 1978; Luthans & Kreitner, 1975; Miller, 1978) and overviews (Andrasik, 1979; Babb & Kopp, 1978; Hamner & Hamner, 1975; Prue, Frederiksen & Bacon, 1978; Schneier, 1974) attest to the growing interest in this area.

Although the behavioral approach has been recognized primarily for its use of reinforcement principles, one of its most potentially fruitful aspects in work settings is its measurement strategies (Bailey, 1977; Goldfried & Kent, 1972; Hall, 1971; Hersen & Barlow, 1976; Johnston, Duncan, Monroe, Stephenson & Stoerzinger, 1978; Kent & Foster, 1977). Behavioral measures can help not only in clarifying and improving performance on the job, but can also be used in training and evaluating employees, as well as in evaluating the effects of policies or programs.

At present, the focus within business and industry is on bottom-line and end-result indices (e.g., sales volume, goods produced, or profit margins). Unfortunately, measures such as these are affected by numerous extraneous factors (e.g., economic conditions, seasonal variables, cost of raw materials) and they do not necessarily provide sensitive measures of employees' performance. As a result, it is difficult to rely solely on outcome measures in assessing and improving the performance of employees.

Behavioral measures are used only infrequently by researchers in the area of industrial/organizational psychology, as a cursory examination of the Journal of Applied Psychology, Organizational Behavior and Human Performance, and Personnel Psychology will prove. Self-report measures or archival records provided by the organization predominate. Dipboye and Flanagan (1979) found in a review of 300 field studies in the journals listed above that half of the articles included only self-report data, i.e., current or retrospective accounts by a person of his or her own behavior, performance, or attitudes.

Behavioral researchers, on the other hand, seldom rely on self-reports of performance. Surprisingly, however, few of the studies conducted in work settings under the rubric of behavior modification use observational measures of performance. Many rely on archival records. Such areas as absenteeism (Kempen & Hall, 1977; Orpen, 1978; Pedalino & Gamboa, 1974; Stephens & Burroughs, 1978), tardiness (Hermann, deMontes, Dominquez, Montes, & Hopkins, 1973), productivity (Adam, 1975; Bourdon, 1977; Chandler, 1977; Emmert, 1978; Kim & Hamner, 1976; Orpen, 1974), cash shortages (Marholin

& Gray, 1976), and turnaround time (Runnion, Johnson, & McWhorter, 1978) lend themselves to the use of archival records and so the focus is on these end result measures. Observational measures, on the other hand, have primarily been used in areas such as occupational safety where there are no tangible results of desired performance (Komaki, Barwick, & Scott, 1978; Sulzer-Azaroff, 1978) and with personnel whose work does not result in an actual product. The personnel however, have primarily been restricted to educational and clinical settings, e.g., teachers (Cooper, Thomson, & Baer, 1970; Cossairt, Hall, & Hopkins, 1973; Hall, Panyan, Rabon, & Broden, 1968) and mental health staff (Iwata, Bailey, Brown, Foshee, & Alpern, 1976; Pommer & Streedbeck, 1974). Little work has been done with service personnel (e.g., salespersons, bank tellers), professionals (e.g., safety officers, architects), or supervisory personnel (e.g., executives, department chairs).

Although the use of behavioral measures in work settings is relatively unexplored, this paper will present some potential advantages of using these measures and describe how they can be used within work organizations. The development of a behavioral measurement system will be illustrated by examples from our recent work. Finally, several research issues and directions will be presented.

Benefits of Behavioral Measures in Work Settings

There are many advantages to using behavioral measures in work settings. Employers can obtain more in-depth and direct information about areas with nonexistent or inadequate measures. Employees can better understand what is expected and the steps involved in attaining end results. The effects

of new programs and policies can be evaluated systematically. This section describes some of these advantages and presents illustrative examples to show how the measures have been used in work settings.

New look at familiar concerns. Behavioral measures make it possible to assess many areas of perennial concern in work settings. In hospital emergency rooms, for example, where the treatment of patients in a prompt and humane manner is of vital concern, systematic measures of the level of employee performance are rarely made. Service delivery involves interactions that typically do not result in any tangible product. One of the reasons for the lack of measurement is that the provision of service does not lend itself to traditional measures such as end result indices. In contrast, behavioral measures often include the specification of complex interactions among persons and the repeated measurement of performance in the situation. As a part of a comprehensive program that was set up to improve services provided to incoming emergency room patients, a behavioral measure was designed to measure "tender loving care" (Komaki, Note 1). The concept of care was behaviorally defined in consultation with the nursing staff and was found to include a variety of different components, including the promptness and quality of greetings and individualized comments (see Table 1). On-site personnel who were not directly involved in the provision of service observed and recorded a sample of patient-staff interactions, using the data sheet shown in Table 2. This measurement system provided direct, objective information about the quality of service to hospital personnel who, until then, had relied on sporadic anecdotal reports.

Insert Tables 1 and 2 about here

Non-filtered information. A particularly important benefit of behavioral measures is that they yield information that is less subject to distortion than the information generated by more traditional methods such as questionnaires and ratings. The latter, in particular, are frequently used as a method of measuring performance. A case in point is the traditional performance appraisal in which superiors rate the performance of their subordinates on an annual or semiannual basis in terms of general traits such as initiative and honesty. The problem with this method of evaluation is that a number of factors, many of which are subjective, enter into the filtering process. The rater not only must make notoriously unreliable judgments, but also must summarize a person's performance over an extended period of time. Behavioral measures, in contrast, minimize the influence of the judgment of the rater by providing operational definitions of performance and by scheduling assessments at frequent intervals. This increases the likelihood that the variance in the measures obtained is due to the behavior observed, not to the rater. Miller (1977), for example, designed an objective worksheet to record the monthly objectives and earnings of salespersons in a nationwide chemical sales organization. The objectives were specified in terms of desired performance related to new business (e.g., visiting potential clients), forecast accuracy (e.g., achieving a standard 25% error), reporting responsibilities (e.g., completing marketing information summaries), and other miscellaneous categories (e.g., maintaining expenses within acceptable limits), as well as in terms of end products (e.g., sales volume). This measurement system provided the basis for the establishment of a token economy program in which bonuses were made contingent on performance.

Clarifying expectations. A key feature of behavioral measures is the pinpointing of desired performance. This specification clarifies expectations about performance and thereby facilitates improvements in performance. End-result measures, on the other hand, often do not clearly specify what employees are supposed to do to achieve the desired outcome. In the area of occupational safety, for instance, primary emphasis is usually placed on reducing the number of disabling and medical treatment injuries. Unfortunately, however, these indices do little to illuminate what employees should do when performing on the job. In several recent studies (Komaki, et al., 1978; Komaki, Heinzmann, & Lawson, Note 2), specific safety practices were identified based on previous accident reports and defined in objective terms as shown in Table 3. Instead of stressing the reduction of accidents, employees were reinforced for consistently performing their jobs in a safe manner with a resulting increase in the level of safe performance and a reduction in the number of injuries.

Insert Table 3 about here

Shaping potential. When behavioral measures are used, the components of a desired performance outcome are typically identified. An additional advantage which results from this is the possibility of designing a shaping strategy based on these components of performance. Desired performance, particularly when complex, seldom occurs in the desired form initially. Schneier (1973) described the use of a shaping strategy with the hard-core unemployed. In assessing the situation he found that most of the trainees dropped out before learning the task. To increase the success rate, he devised a shaping program in which the behavioral components of the task were first specified.

Reinforcers were then provided after successful completion of the first component. Later, completion of more components was required for reinforcement until the entire task was accomplished. The result was the successful achievement and maintenance of the desired task by reinforcing successive approximations to that performance.

Alternative evaluation strategies. The repeated measurement of performance is advantageous because it provides the basis for within-group experimental designs. These designs are especially appropriate in evaluating the effects of programs in organizations. In most work settings personnel cannot be randomly assigned to different treatment groups. Within-group designs, however, can be readily applied to existing departments, groups, or plants and are comparable with control group designs in terms of the conclusions one can draw (Komaki, 1977). Kempen and Hall (1977), for example, employed a multiple-baseline design across different plants to evaluate the effects of an absenteeism reduction program in a large manufacturing company.

Assessment of changes over time. The use of repeated measures also provides a more detailed view of performance as it changes over time. This is particularly important in monitoring the effects of programs. For instance, Panyan, Boozer, and Morris (1970) used a repeated measurement system to assess the effects of a training and a feedback system on the behavior of institutional staff. Weekly measurements made it possible to assess the dwindling effect of the training and to take corrective actions. If the authors had used a pre-post evaluation system to assess the effects of the training program, their conclusions might have been totally different. Depending on how long after the training course the post measurement took place, they would have

concluded the training was a complete success, moderately fruitful, or not worth the trouble. None of these conclusions would have reflected the true course of events.

Potential Uses of Behavioral Measures in Work Settings

The use of behavioral measures is a key feature of many motivational programs designed to improve work performance. The potential utility of these measures, however, is not confined to these programs alone. There are several organizational functions that could benefit from the use of these measures.

Behavioral measures could be used to great advantage in the area of training. As reviews of the training literature attest (Campbell, 1971; Goldstein, in press), most training programs are designed with little or no systematic assessment of training needs, and such programs are rarely evaluated. It is commonly assumed that training is effective, but few data are collected. When the effects of training are evaluated, the primary measures are the participants' subjective reactions to the experience and possibly a didactic examination of the topics discussed. Assessments are rarely made to determine whether participants actually changed their performance on the job. Behavioral measures could provide valuable information in both the assessment of training needs and training evaluation, particularly when combined with behavioral specifications of desired job performance. Direct observations of performance would reveal which skills demonstrated on the job are adequate and which are not. Training programs could then be designed to address the specific deficiencies observed. Evaluation of the effects of training would consist of a continued assessment of the skills covered in training in order to determine if improvements in these specific areas of performance occurred during training and were maintained on the job.

Behavioral measures could also be used to great advantage in performance appraisal, the periodic evaluation of an employee's performance in the organization. The most commonly used measure of managerial personnel, for example, is global ratings (e.g., rank all managers in Divison Q in terms of their overall effectiveness), as discussed in the classic text on managerial effectiveness (Campbell, Dunnette, Lawler, & Weick, 1970). While interrater agreement is usually acceptable, the basis on which judgments are made is not clear. Global ratings yield no information about managers' differing levels of effectiveness in handling different aspects of their jobs. Outcome measures (e.g., quantity of organizational output, absenteeism rates) are frequently used as an alternative to global ratings, but the sole use of these also presents a problem because the outcomes may not be totally under the manager's control. In the job of a district manager, for example, sales volume is affected by economic conditions, territorial differences, competitive advantages, and advertising, as well as by the efforts of the district manager and the sales force. Another measurement approach is dimension based. With dimension-based scales, job dimensions (e.g., quality, knowledge, punctuality) are anchored by scale points in the form of numbers, adjectives, or behaviors. See Table 4 for examples of dimension-based scales with numerical and adjectival scale points that have been used recently to evaluate top level government officials. The major drawback of these scales is that the dimensions and the anchor points are not clearly defined. A person who is rated low in terms of quality of work, for instance, may not learn from the evaluation how to improve work quality.

Insert Table 4 about here

Another measurement approach recently recommended by some industrial/organizational psychologists (e.g., Blood, 1974) is a dimension-based scale with behavioral scale points. Referred to as "behaviorally anchored rating scales" or "behavioral expectation scales (BES)", the scale anchors are behaviors rather than adjectives or numbers as illustrated in Table 5. A sales manager,

Insert Table 5 about here

for example, may be rated fairly well on the dimension of supervision because he or she "could be expected to exhibit courtesy and respect toward his sales personnel." Although BES are a considerable improvement over global, outcome, or dimension-based scales with numerical or adjectival scale points (e.g., DeCotiis, 1977), they do not constitute behavioral measures. The behaviors that a superior has seen a manager demonstrate may not resemble any of the specific anchors on the scales. As a result, the manager is required to extrapolate from observed behaviors to those which could be "expected" as defined by the scale anchors. In addition, superiors do not observe <u>in situ</u> and then record immediately. Another difference is that performance is estimated relatively infrequently and summarized over fairly long periods of time (three to six months would not be unlikely). The assumption is that raters can capture accurately differences in performance that span months in time by means of a single index. Behavioral measures, on the other hand, differ from the measures typically

used in the area of performance appraisal. Desired job behaviors are defined objectively, and performance is measured in the job setting on a frequent basis, as often as daily and no less than monthly. The use of behavioral measures of performance provides objective and reliable information about a given person's performance. This information can be used to make suggestions for improvements, to provide criteria for the allocation of organizational rewards (e.g., salary increases), and to identify promotable employees from the internal work force.

As yet, there are few reports of the use of behavioral measures in the areas of training or performance appraisal. Nevertheless, there are discernible trends in the direction of more specific measures of job performance and an increasing recognition of the potential value of these measures. Some industrial/organizational psychologists are beginning to caution against the predominant use of indirect methods and to emphasize the importance of describing behaviors in concrete, observable terms (Campbell, 1971, 1977; Beatty, Note 3).

There is also an increasing emphasis on detailed specification of job performance in two major areas (goal setting and management by objectives) of the industrial/organizational psychology literature (e.g., Locke, 1968; McConkie, 1979). There is growing evidence that specific goals, when accompanied by feedback, lead to higher productivity than vague, unspecified "do your best" type exhortations (Becker, 1978; Erez, 1977; Strang, Lawrence, & Fowler, 1978). Judging from the trends thus far, there is little doubt that the use of behavioral measures will find increasing acceptance in the future.

Instrument Development

Numerous decisions must be made in the process of developing a measurement system. The first decision involves selecting one area of interest from

the spectrum of potential areas. Once the area of interest has been selected, it is necessary to determine the various components of performance that contribute to that area and the desired outcome of that performance. The best methods of measuring these particular components must then be established.

Although the choice of dependent variables has been acknowledged as crucial to the quality of research efforts (Ellingstad & Heimstra, 1974), the behind-the-scenes decisions surrounding the choice and the operational definition of measures are rarely discussed in the literature. Kent and Foster (1977) lament the fact that "such basic measurement decisions seem to reflect the whim or habits of the individual investigator" (p. 318) and suggest systematic and empirical attention to these aspects. In this section some of the considerations involved in the development of a measurement instrument will be discussed. An example from our recent study in the military will be used in illustration. Although the considerations presented are not exhaustive they are representative of those which led to the selection of the final measurement system.

Preventive maintenance study. The purpose of the study was to design, implement, and evaluate a behavior analysis program to improve preventive maintenance in a Fleet Marine Force Unit. Improvements were desired in preventive maintenance so as to prolong the useful life of equipment. As a result of the many activities and conditions that were found to comprise the area, the measurement system included five separate components of preventive maintenance.

a) Time utilization. Monitors observed and recorded the number of individuals present and engaged in preventive maintenance.

b) Supervision. Monitors observed and recorded whether a supervisor

was present when subordinates were on duty.

c) Knowledge/training. Monitors assessed the operators' knowledge of weekly preventive maintenance activities.

d) Action taken. Monitors determined the extent of follow-through, i.e., whether items identified as needing attention were corrected or the necessary actions for ordering parts or further repairs were initiated promptly.

e) Condition of vehicles. Limited Technical Inspections were conducted to determine the condition of a sample of vehicles each week.

Observations were conducted by retired Marines on a weekly basis during scheduled preventive maintenance times for items a, b, c, and d. An independent inspection unit was responsible for item e.

Because different components of maintenance were considered, it was possible to assess what specific areas needed improvement. A sensitive measure of the level of performance could be obtained since performance was observed directly in situ and immediate products of behavior (e.g., the repaired part) were examined. It was possible to employ a multiple-baseline design and to identify trends in performance with repeated measurement. Finally, various sources of error were minimized by employing different converging measures of preventive maintenance.

Steps in instrument development. The first decision involved in measurement development, the identification of an area of interest, often goes unrecognized, as though the choice of dependent variables was immediately apparent. In work settings, decision-making is normally a joint process between on-site personnel and researchers, with the former leading the way. On-site personnel usually identify areas of interest to them and researchers choose among those

presented in accordance with their own interest and expertise. Rarely, if ever, do researchers successfully persuade on-site personnel to seriously consider areas that they themselves do not think are important.

In the preventive maintenance study, safety initially concerned persons in one section of the organization; however, former commanding officers noted that equipment maintenance rather than safety was a recurring problem. Further discussions revealed that most of the problems were perceived to occur with the lowest level workers who were not full-time maintenance personnel and whose primary duties were not maintenance-related (operators and crewmen). Therefore, research efforts were focused on these persons.

Once the area of interest is identified, the next step is to determine the different components of the area to be measured. In work settings, on-site personnel usually focus on end results or bottom-line indices; they seldom identify specific areas of performance which need improvement. As a result, it is necessary to determine all the ways in which performance can contribute to the desired outcome in order to determine which components of the area of interest are to be measured. To identify the various components of an area of interest, four sources of information are typically used:

a) On-site personnel, including supervisory, on-line, and staff personnel;

b) Archival records such as policy statements, technical manuals, organization charts, and annual reports;

c) Existing systems related to the area of interest such as ongoing record keeping procedures; and

d) Pertinent business and professional literature, e.g., industrial/organizational psychology journals, technical reports, and trade magazines.

In the preventive maintenance study, all of these sources of information

were used, and persons at all levels of the organization were consulted. A large array of archival records ranging from technical manuals to a division inspection checklist (the single most helpful document) were perused. Three primary systems related to preventive maintenance were identified: a computerized information system reflecting the current status of all vehicles; an independent inspection unit which audited maintenance performance on an annual basis; and a motor transport school which provided specific instruction in the area of preventive maintenance. Lastly, a search of the literature, primarily technical reports, was conducted.

Based on the above sources of information, four aspects of performance were identified as components of the area of preventive maintenance. Time utilization was mentioned by on-site personnel in particular as an important factor, with persons noting either the minimal number of hours per week scheduled for maintenance activities or the minimal time spent by personnel during these time periods. Supervision was included because on-site personnel felt there was a direct relationship between the amount of supervision and the quantity and quality of work. The importance of adequate training was suggested by anecdotal reports of the effects of incorrect maintenance and by the literature review which was predominated by training-oriented studies. The extent of follow-through was judged to be an important component as a result of two factors: an emphasis was placed on ongoing record keeping by the independent inspection unit and repairs requiring additional parts or higher level maintenance could not be accomplished if proper records procedures were not initiated. In addition to these areas of performance, the vehicles themselves were examined to assess whether improvements in performance would have an effect on the condition of the vehicles.

The next step in the design of the measurement system is to determine the specific methods of data collection. While it might appear that these methods would be obvious, there are many decisions yet to be made. Quite often the measures that would be most appropriate from a methodological standpoint are not practical to implement. Constraints are imposed by the necessity of working within an existing operational structure which place limits on or preclude measurement alternatives. Consequently, compromises must be made to achieve the best practical balance of the ideal and the feasible. In the preventive maintenance study, for example, plans were initially made to have monitors observe persons conducting weekly preventive checks and record whether or not specific items in need of maintenance were correctly identified or serviced or both. Problems were encountered with this initial approach, however. Items on the preventive maintenance checklist were not completed in any specific order and personnel did not immediately note which items they had checked, thereby making it difficult to assess the correspondence between persons' actions and items on the checklist. The checks often required only visual inspections and involved vehicle parts in locations accessible to only one person at a time, thereby making it difficult for monitors to assess reliably whether designated items had been checked properly. As a result of these difficulties, the initial approach was determined to be unfeasible. In its place, two measurement systems were designed. One, Time Utilization, involved a procedure in which monitors recorded the number of persons who were present and the number of persons on task during scheduled maintenance periods. The definition of on task included general activities such as manipulation of vehicle parts and marking of checklists. The second, Action Taken, started with a sample of individual items in need of maintenance or repair. Monitors (or designated

mechanics) examined the items independently and noted whether the items were corrected or whether the necessary actions for ordering parts or further repairs were initiated, or both.

Another set of decisions involves sampling. Usually one cannot collect data on all persons at all times on all aspects under all conditions. As a result it is necessary to sample. In the preventive maintenance study decisions had to be made about which personnel to query, which vehicles to monitor, which questions to ask, and which items to examine. In such cases as vehicle selection, random sampling with replacement was used. In other cases, selection was made on the basis or priorities. For instance, select items needing repair were chosen for assessment of action taken each week. The priorities were established by having on-site personnel rate the importance of all items on the weekly preventive maintenance checklists on a seven-point scale. Based on these ratings, the items were then rank ordered. In each vehicle selected for examination, the three items having the highest ranks were selected for further analysis. In this way, those items which were judged to be more important were emphasized rather than given equal weight with those items considered to be less important.

General considerations in measurement development. The formulation of the measurement systems in the preventive maintenance study highlights the process of instrument development. In this particular situation, the process was directed by some general guidelines that are relevant to a variety of work settings.

First, it is necessary to keep the original area of interest firmly in mind. It is often tempting to select measures because of their convenience and availability. Unfortunately, however, available indices sometimes do not reflect the area of interest. Although checklists were readily available

in the preventive maintenance setting, they reflected what persons said they did rather than what they actually did.

It also is important to select measures that reflect worker performance as directly as possible. Measures that concentrate solely on end results are often insensitive to performance changes on the part of workers. It was found in the preventive maintenance study, for example, that the condition of the vehicles, an end result measure, could be affected by such factors as the age of the vehicles, the supply system, variations in use, and the availability of funds, as well as by preventive maintenance activities.

Finally, it is advantageous to use more than a single measure of the area of the interest. This strategy makes it possible to pinpoint individual areas of performance that need improvement. It also provides converging information, which can help to rule out different sources of error. Finally, when end result measures are used in combination with measures of performance, the relationship between these two can be assessed.

Implementation Issues and Future Research Directions

Although there are many benefits associated with the use of behavioral measures in work settings, several issues remain concerning their use. Questions are frequently raised by both researchers and practitioners regarding the reactions of workers to the fact that they are being observed and the potential biases of the persons doing the observing. Another more technological issue involves the cost of collecting behavioral observations. In the next section these issues are discussed and some suggested directions for future research are outlined.

Knowledge of being observed. As indicated above, some of the questions most frequently asked about the use of direct observations involve employees'

knowledge that observations are taking place. Can the improvements obtained in performance be attributed to the fact that observers know that they are being observed? How do you know that employees are not behaving differently when observers are present than when they are not there? Questions such as these involve the reactivity of the measures. While most questions of this type do not distinguish very clearly between them, reactivity effects can pose two types of threats to validity, one to internal validity and one to external validity.

Reactivity is a problem for internal validity if there is the possibility that the knowledge of being observed contributes to changes in performance. In many cases, however, this is not of concern. In situations where the performance of workers is being observed repeatedly in a within-group experimental design, direct observations are conducted during both baseline and treatment conditions. Therefore, improvements in performance during treatment cannot be due to the reactivity of the measure per se. Any presumed lasting effect of the reactivity of the measure would occur during both baseline and treatment situations and should contribute a constant error throughout the course of observation. When control group designs are used, however, it should be determined whether all groups were observed. If so, improvements cannot be attributed to the reactivity of the measure. If not, then reactivity may be a plausible alternative hypothesis and conclusions should be drawn accordingly.

While reactivity typically poses minimal threats to internal validity, questions concerning external validity are not so easily answered. Can the results be generalized only to situations in which observers are present? In many work settings, programs are set up in such a way as to satisfy the conditions under which discrimination learning occurs. The observer's presence

is associated differentially with the delivery of consequences for the behaviors observed. Only when the observer is present are the behaviors observed related to the outcomes provided in the program. A possible outcome of this arrangement is that the observer will become a discriminative stimulus for performance, i.e., improvements will be obtained, but they will be confined to the presence of the observers. Although the question of generality is frequently raised by both practitioners and researchers, there is little evidence on the effects of observers on workers' performance. Future work which recognizes this type of reactivity issue as a question of the stimulus control of performance should contribute to our understanding of the conditions under which such effects occur, as well as methods for dealing with this potential concern.

Our recent experience in work settings, while not directly concerned with reactivity issues, provides some encouraging evidence on this issue. In a study of safety in a food manufacturing firm (Komaki, et al, 1978), observers recorded the performance of workers on the plant floor for 55-minute periods, four times a week for six months. Substantial improvements in performance were reflected in the data collected by these observers when a safety improvement program was introduced. Support for the generality of these improvements was provided by the accident records for that period, which showed that the injury frequency was reduced by a factor of five after the introduction of the safety program. Since the observation periods comprised only a small percentage of the working hours, it is unlikely that such substantial improvements could have been obtained had the improvements been confined to the periods during which the observers recorded performance. The use of an end result measure such as this in conjunction with direct observational

measures can provide helpful information regarding the generalization of improvements to non-observation periods.

Efforts are underway to address this issue of the generalization of results in our current research. Presently, safety performance is being observed for approximately one hour, three times a week by outside observers. In addition, in-house personnel have been asked to observe the same behaviors as those noted by the outside observers at other times and in a manner that does not reveal that they are recording. These in-house observations will provide an indication of the extent to which performance obtained in the presence of known observers is maintained in their absence.

Observer bias. A related concern involves the possible biases of the persons recording the data. In work settings, the role of observer can be served by outside observers, supervisory personnel, or the employees themselves. Supervisory personnel have been identified traditionally as the most likely candidates to obtain information about the performance of their subordinates. However, their credibility is sometimes questioned because of the notoriously subjective judgments they are typically asked to make. Employees are often assumed to be too lenient in evaluating their performance, although recent reports from the job redesign and enrichment literature indicate positive results when employees are given responsibility for monitoring their own work (Ford, 1973; Janson, 1971). Outside observers are likely to be perceived as more objective since they are not subject to evaluative influences within the organization. Nevertheless, it may not be feasible to use them in many work settings.

While these notions of the relative biases of the different observers are intuitively reasonable, there is very little systematic information avail-

able on this topic. Furthermore, other variables may have greater impact on the potential biases in observation. Supervisors as a group, employees as a group, or outside observers as a group are probably not more or less likely to provide accurate information as a function of their position in the organization. Rather, the contingencies under which they operate and the ways in which the data are used are likely to be responsible.

Various ways of minimizing potential bias have been suggested (Kent & Foster, 1977; Nelson, 1977). Highly specific codes, for example, have been found to be less subject to bias than more global ratings. The accuracy of self-monitoring has been found to be enhanced by monitoring accuracy and by reinforcing persons for reporting accurately. Self-monitoring of performance can be a potentially useful tool in work settings, particularly with professional and supervisory personnel. Unfortunately, the latter suggestion for enhancing accuracy requires a second estimate of performance (e.g., information collected by the worker regarding time spent on task A and B and collaborative information collected by another source). In many work settings, additional estimates of performance are not readily available so that it is difficult to monitor or reinforce accuracy except on a very lean schedule. Further attempts to assess the conditions under which persons are more likely to provide unbiased observations would contribute substantially to the utility of direct observational measures.

Measurement costs. Contrary to some popular views, the relative costs of collecting direct observations as opposed to more traditional measures is not of paramount concern with persons in business, industry, and government settings. One of the reasons for this lack of concern may be related to the fact that there is little information regarding the cost of traditional measures.

Although businesses and industries are all concerned with bottom-line indices, few organizations systematically estimate the worth of their human resources, let alone the costs involved in measuring employee performance. Such well-established functions as training and such long standing problems as turnover are infrequently assessed in terms of their direct and indirect costs.

Presently, little information is available about the costs of measuring performance, whether it be using traditional or behavioral measures. If costs are discussed, they are usually based on gross estimates or they neglect indirect costs such as supervisory time spent coordinating the system.

Behavioral researchers are encouraged to follow the lead of some pioneers in the profession of accounting where changes are taking place as a result of a broadening concept of economic effectiveness. Variables which have traditionally been used to represent economic effectiveness include items such as the volume of goods or services produced and the cost of output. Recently, however, attention has focused on such nonproductive events as absenteeism, turnover, and work disruptions. Several accounting methods have been proposed (Alexander, 1971; Flamholtz, 1974; Macy & Mirvis, 1976), to express indicators of work performance that fit this broader conception of effectiveness in financial terms. Distinctions are made between asset models and expense models in human resource accounting. Asset models reflect the organizations' investment in employees and are directed toward assessing the value of employees as capitalized resources. Expense models, on the other hand, measure the economic effects of employees' behavior.

Using the human resource accounting expense model (Macy & Mirvis, 1976; Mirvis & Lawler, 1977), we are currently attempting to assess systematically

the financial impact of improved safety practices that result from a safety improvement program. Determinations are made so as to assign fixed, variable, or opportunity costs to various behaviors. When an accident occurs, for example, one first asks whether a) the worker is missing from his/her station, b) there is a replacement from an extra work force, or c) a replacement is t nsferred from another job. If it is determined that a replacement is transferred from another job, then one assesses whether the replacement is adequately trained for the job and determines production and quality changes, and training costs. The above model might be useful in estimating the costs involved in implementing a behavioral measuring system as opposed to a more traditional measurement system. If more costs are incurred for the former, which is probably the case, then one might wish to determine whether the benefits outweigh the additional costs. Whatever the outcome, the information could be used when discussing the relative merits of the different types of measurement strategies. Another alternative would be to design different types of behavioral measures and determine their relative costs so as to identify the most cost-effective type of measure. There is probably a balance between the richness of the information obtained (and the cost) and the potential benefits.

Summary

Within the last decade, programs based on a behavioral approach to management have been successful in improving performance in a wide variety of business, industry, and government settings. One of the most promising aspects of the behavioral approach is its measurement strategies. The objective definition of desired performance and the repeated measurement of these behaviors in the job setting are in contrast to traditional measures used in work settings. In spite of their promise, behavioral measures are seldom used by either practitioners or researchers in work settings. Businesses and industries commonly use end result or bottom-line indices, whereas industrial psychologists typically employ self-report measures.

Benefits associated with the use of behavioral measures are manifold. They provide information about areas with nonexistent or inadequate measures; they yield relatively direct, non-filtered information about performance; they help to clarify expectations about performance; they provide the possibility of using shaping strategies; they lend themselves to within-group evaluation designs; and they provide the basis for assessing changes in performance over time. In addition to their use in motivational programs, behavioral measures are potentially beneficial in the areas of training and performance appraisal. Recent trends in the industrial/organizational literature indicate that behavioral measures will be increasingly accepted in the future.

Our preventive maintenance study illustrates the steps taken in the development of a measurement instrument in a work setting. These include: 1) identifying the area of interst, 2) determining the various components of the area of interest, and 3) selecting specific measurement strategies. In work settings

the first step is normally a cooperative process involving both on-site personnel and researchers, with the former leading the way. To determine the ways in which performance can contribute to the desired outcome, on-site personnel, archival records, existing systems, and pertinent literature should be consulted. The selection of specific methods of data collection may require a compromise between the ideal and the feasible. General guidelines for instrument development include constant referral to the original area of interest, the choice of measures that are as directly related to worker performance as possible, and a consideration of multiple measures as a means of providing converging information.

Although behavioral measures are increasingly being used in work settings to great advantage, several issues concerning direct observations remain unresolved. Three problems in particular are cited with regard to the effects of the knowledge of being observed, the possibility of observer bias, and the relative costs of implementing behavioral measures. Because these issues are critical for practitioners and researchers alike, further research directed to their resolution is certain to have a major impact on the successful use of behavioral measures in work settings.

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3. Beatty, R. W. A comparison of the operationalization of behavior-based vs. effectiveness-based performance appraisals. Paper presented at the meeting of the American Psychological Association, San Francisco, September 1977.

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Footnotes

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Table 1

Sample Items in Behavioral Measure of

Tender Loving Care in a Hospital Emergency Room (ER)

1. Did one of the ER staff acknowledge (e.g., I'll be with you in a moment. Smile or nod) the patient (or one of the members of his/her party) within 15-seconds of the patient standing in front of (within 3 feet) the ER counter?
2. Was the patient given a greeting (e.g., Good afternoon, Can I help you?)
3. Did the staff member look at the patient when s/he greeted him/her?

.

.

.

6. Did the staff member make an individualized comment to the patient (e.g., We just had another patient with a bee sting yesterday. or You're looking really flushed. Would you like to take a seat while I finish getting this information?)?

Source: Komaki, Note 1.

Table 2

Data Sheet Used to Record Care

in a Hospital Emergency Room (ER)

Check the appropriate boxes for each patient-staff interaction

Time	Yes	No	N/A or N/O
1. Within 15-seconds	☐	☐	☐
2. Greeting	☐	☐	☐
3. Eye contact during greeting	☐	☐	☐
4. Introduction of ER Record	☐	☐	☐
5. Eye contact during introduction	☐	☐	☐
6. Individualized comment	☐	☐	☐
7. Eye contact during comment	☐	☐	☐
8. Within arm's reach	☐	☐	☐
9. Time → Dr.	☐	☐	☐
10. Next step	☐	☐	☐

Source: Komaki, Note 1.

Table 3

Sample Items in Behavioral Measure of Safety in a Food Manufacturing Plant

Makeup department
When picking up pans from the conveyor belt, no more than two pans are picked up prior to placing the pans on the pan rack.
Roll pans are stacked no higher than the rear rail of the pan rack.
When lifting or lowering dough trough, hand holds and at no time loses contact with dump chain.
When pulling dough trough away from dough mixer, hands are placed on the front rail of the dough trough and not on the side rails.
Wrapping department
There are no cardboard spacers (defined as cardboard 30 mm square or larger) on the floor.
When cutting wire bands from stacks of boxes or spacers, employee cuts with one hand and holds the metal strap above the cut with the other hand.
When moving conveyor, at least one person is on each end.
When handling a skid, employee attempts to break its fall in some manner, for example, sliding it off rather than letting it fall flat on the floor.
Both departments
When mechanical problems arise (e.g., pans jam on conveyor belt, belt breaks), the machine is turned off (the machine is off when the on-off switch is in the off position and machine moving parts have stopped) or maintenance is notified.

Source: Komaki, Barwick, & Scott, 1978.

Table 4

Example of Dimension-Based Rating Scales

with Numerical and Adjectival Scale Points

How well does this person get along with:

Superiors	1	2	3	4	5	6
Peers	1	2	3	4	5	6
Subordinates	1	2	3	4	5	6
Outsiders	1	2	3	4	5	6
	not well					very well

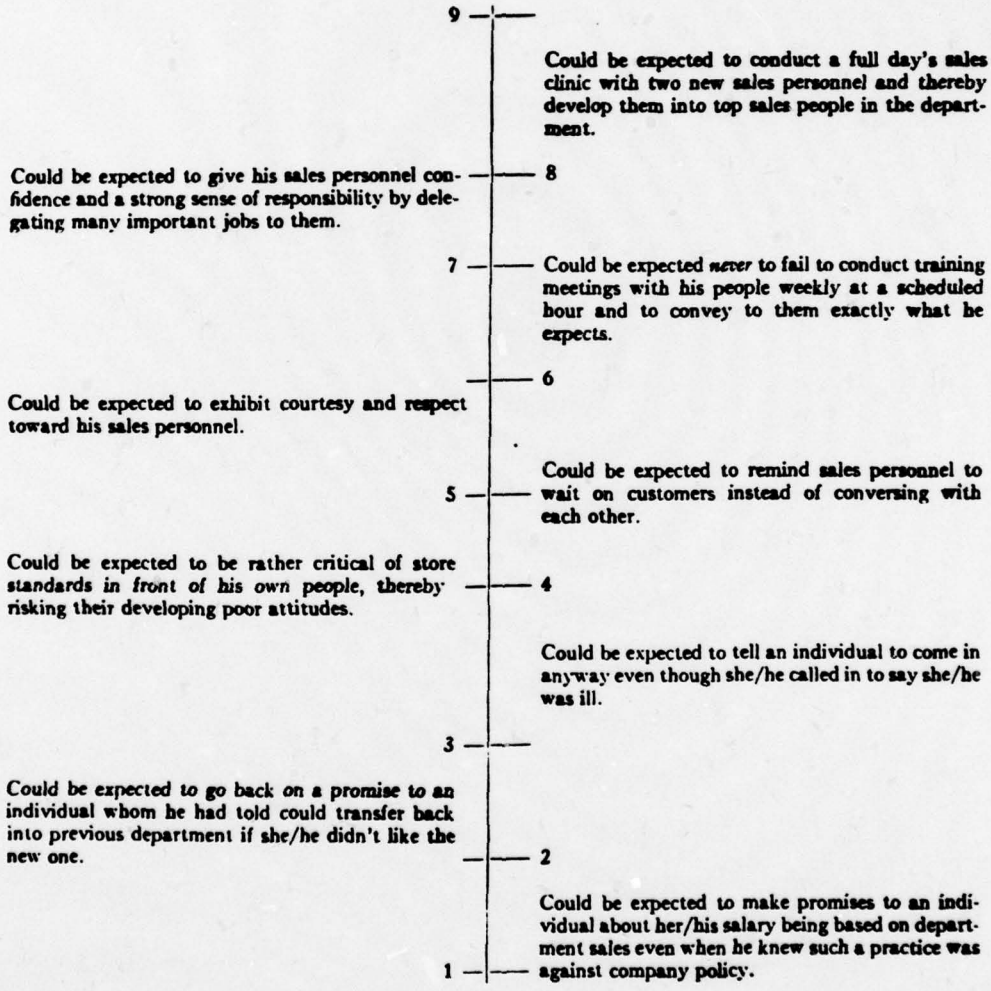
How confident is this person?

X	X	X	X	X	X
self-doubting		confident			cocky

Source: Newsweek, 1979.

Table 5

Behavioral Expectations Rating Scale for the Effectiveness with which Department Managers Supervise their Sales Personnel



Source: Campbell, Dunnette, Arvey, & Hellervik, 1973.

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